

FORM PTO-1390(Modified) REV 11-98)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER <b>0112740-143</b>
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>09/763444</b>
INTERNATIONAL APPLICATION NO. <b>PCT/DE99/02649</b>	INTERNATIONAL FILING DATE <b>24 August 1999</b>	PRIORITY DATE CLAIMED <b>24 August 1998</b>		
TITLE OF INVENTION <b>A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM COMMUNICATIONS NETWORK</b>				
APPLICANT(S) FOR DO/EO/US <b>Siegfried Huber et al.</b>				
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ul> </li> <li>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> <li>8. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input checked="" type="checkbox"/> have not been made and will not be made.</li> </ul> </li> <li>9. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>10. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).</li> <li>11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li>12. <input checked="" type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> </ol> <p><b>Items 13 to 20 below concern document(s) or information included:</b></p> <ol style="list-style-type: none"> <li>13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>15. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment.</li> <li>16. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>17. <input type="checkbox"/> A substitute specification.</li> <li>18. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>19. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail</li> <li>20. <input checked="" type="checkbox"/> Other items or information: <b>Submission of Drawings Figure 1 on one sheet</b></li> </ol>				

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>09/763444</b>	INTERNATIONAL APPLICATION NO. PCT/DE99/02649	ATTORNEY'S DOCKET NUMBER 0112740-143
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21. The following fees are submitted:

**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :**

- |   |            |
|---|------------|
| <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... | \$1,000.00 |
| <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO .....   | \$860.00   |
| <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....   | \$710.00   |
| <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) .....  | \$690.00   |
| <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) .....  | \$100.00   |

**ENTER APPROPRIATE BASIC FEE AMOUNT =**

**\$860.00**

Surcharge of \$130.00 for furnishing the oath or declaration later than  20  30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

**\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	5 - 20 =	0	x \$18.00	<b>\$0.00</b>
Independent claims	1 - 3 =	0	x \$80.00	<b>\$0.00</b>
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
			<b>TOTAL OF ABOVE CALCULATIONS</b>	<b>= \$860.00</b>
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
			<b>SUBTOTAL</b>	<b>= \$860.00</b>
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).			<input type="checkbox"/> 20 <input type="checkbox"/> 30 +	<b>\$0.00</b>
			<b>TOTAL NATIONAL FEE</b>	<b>= \$860.00</b>
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>
			<b>TOTAL FEES ENCLOSED</b>	<b>= \$860.00</b>
			Amount to be: refunded	\$
			charged	\$

A check in the amount of **\$860.00** to cover the above fees is enclosed.

Please charge my Deposit Account No. in the amount of to cover the above fees.  
A duplicate copy of this sheet is enclosed.

The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

William E. Vaughan  
Bell, Boyd & Lloyd LLC  
P.O. Box 1135  
Chicago, Illinois 60690-1135

  
SIGNATURE

William E. Vaughan

NAME

39,056

REGISTRATION NUMBER

February 21, 2001

DATE

09/763444

JCOB Rec'd PCT/PTO 21 FEB 2001

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE  
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

5

**PRELIMINARY AMENDMENT**

APPLICANTS: Siegfried Huber et al. DOCKET NO: 112740-143  
SERIAL NO: GROUP ART UNIT:  
10 INTERNATIONAL APPLICATION NO: PCT/DE99/02649  
INTERNATIONAL FILING DATE: 24 August 1999  
INVENTION: A METHOD FOR TRANSMITTING AN ATM-ORIENTED  
CELL STREAM VIA AT LEAST TWO VIRTUAL  
15 CONNECTIONS IN AN ATM COMMUNICATIONS  
NETWORK  
20 Assistant Commissioner for Patents,  
Washington, D.C. 20231  
Sir:  
Please amend the above-identified International Application before entry  
into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C.  
§371 as follows:

25 **In The Specification:**

On page 1, cancel lines 1-5 and substitute the following therefor:

**--S P E C I F I C A T I O N**

**TITLE**

30 **A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL  
STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM  
COMMUNICATIONS NETWORK**

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

The present invention relates, generally, to an ATM-oriented cell stream which is transmitted via an ATM communications network in which at least two virtual connections are provided and, more particularly, to such a method wherein the ATM-oriented cell stream is distributed between the at least two virtual connections  
5 and in which, at least at times, synchronization cells are regularly inserted into the virtual connections.

**Description of the Prior Art--.**

- On page 1, line 7, cancel “the”.
- On page 1, lines 9-10, cancel “by means of” and substitute therefor --via--.
- 10 On page 1, line 10, cancel the “,” and substitute therefor a --;--.
- On page 1, line 10, cancel “to say” and substitute therefor a --,--.
- On page 1, line 15, cancel “is”.
- On page 1, line 15, insert --is-- after “also”.
- On page 1, line 31, cancel “are” and substitute therefor --being--.
- 15 On page 2, line 11, cancel “means of”.
- On page 2, line 12, cancel “comprise” and substitute therefor --include--.
- On page 2, line 18, cancel the “-“ and substitute therefor a --;--.
- On page 2, line 18, cancel “to say” and substitute therefor a --,--.
- On page 2, line 20, cancel “- while” and substitute therefor --. However--.
- 20 On page 2, line 38, cancel the “-“ and substitute therefor a --;--.
- On page 2a, line 1, cancel “is” and substitute therefor --being--.
- On page 2a, line 2, insert --also-- after “technology”.
- On page 3, line 1, cancel “also”.
- On page 3, line 4, cancel “and”.
- 25 On page 3, line 4, cancel “is” and substitute therefor --being--.
- On page 3, line 19, cancel “, which” and substitute therefor --. This--.
- On page 3, line 26, cancel the “,”.
- On page 3, line 34, cancel the “,” and substitute therefor a --;--.
- On page 3, line 35, insert a --,-- after “example”.

- On page 4, line 15, cancel the “-“ and substitute therefor a --;--.
- On page 4, line 15, cancel “is” and substitute therefor --being--.
- On page 4, line 30, cancel “, as” and substitute therefor --. As--.
- On page 4, line 31, cancel “of which” and substitute therefor a --,--.
- 5 On page 5, line 2, cancel “in” after “headers” and substitute therefor --is--.
- On page 5, line 10, insert --present-- before “invention”.
- On page 5, line 10, cancel “based on the object of” and substitute therefor --directed to--.
- On page 5, before line 15, insert the following centered heading:
- 10 **--SUMMARY OF THE INVENTION--**
- On page 5, line 15, cancel “The” and substitute therefor --A--.
- On page 5, line 15, insert --present-- before “invention”.
- On page 5, line 24, cancel “according to” and substitute therefor --of--.
- On page 5, line 24, insert --present-- before “invention”.
- 15 On page 5, line 28, insert --present-- before “invention”.
- On page 5, line 29, cancel “mean that” and substitute therefor --allow--.
- On page 5, line 29, cancel “is” and substitute therefor --to be--.
- On page 5, line 36, cancel the “-“ and substitute therefor a --;--.
- On page 5, line 36, cancel “to say” and substitute therefor a --,--.
- 20 On page 6, line 4, cancel “refinement” and substitute therefor -- embodiment--.
- On page 6, line 5, insert --present-- before “invention”.
- On page 6, line 7, cancel “- claim 2”.
- On page 6, line 13, cancel “refinement” and substitute therefor --
- 25 development--.
- On page 6, line 13, cancel “according to” and substitute therefor --of--.
- On page 6, line 14, insert --present-- before “invention”.
- On page 6, line 15, cancel “- claim 3”.
- On page 6, line 20, cancel the “-“ and substitute therefor a --;--.

- On page 6, line 20, insert a --,-- after "example".
- On page 6, line 24, cancel "comprises" and substitute therefor --includes--.
- On page 6, line 29, cancel "according to" and substitute therefor --of--.
- On page 6, line 30, insert --present-- before "invention".
- 5 On page 6, line 33, cancel "- claim 4".
- On page 7, line 1, insert --further-- before "development".
- On page 7, line 1, cancel "according to" and substitute therefor --of--.
- On page 7, line 2, insert --present-- before "invention".
- On page 7, line 5, cancel "- claim 5".
- 10 On page 7, line 10, cancel "According" and substitute therefor --Pursuant--.
- On page 7, line 10, cancel "one development" and substitute therefor --another embodiment--.
- On page 7, line 11, insert --present-- before "invention".
- On page 7, line 13, cancel "- claim 6".
- 15 On page 7, line 16, cancel "can".
- On page 7, line 16, insert --can-- after "still".
- On page 7, line 19, cancel "one" and substitute therefor --yet another--.
- On page 7, line 19, cancel "according to" after "method" and substitute therefor --of--.
- 20 On page 7, line 20, insert --present-- before "invention".
- On page 7, line 22, cancel "- claim 7".
- On page 7, line 27, cancel "according to" and substitute therefor --of--.
- On page 7, line 28, insert --present-- before "invention".
- On page 7, line 31, cancel "- claim 8".
- 25 On page 7, after line 36, insert the following paragraph:  
--Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.--
- On page 8, cancel lines 1-5 and substitute the following therefor:

**--DESCRIPTION OF THE DRAWINGS**

Figure 1 shows an exemplary embodiment of the ATM communications network in accordance with the teachings of the present invention in which a number of virtual connections are provided.

**5    DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--**

- On page 8, line 6, insert --Referring to Fig. 1,-- before the "(“.
- On page 8, line 8, cancel “by means of” and substitute therefor --via--.
- On page 8, line 9, cancel the “-“ and substitute therefor a --;--.
- On page 8, line 9, cancel “the figure” and substitute therefor --Fig. 1--.
- 10    On page 8, line 23, insert --be-- after “can”.
- On page 8, line 23, cancel “be”.
- On page 8, line 24, cancel the “-“ and substitute therefor a --;--.
- On page 8, line 24, cancel “is”.
- On page 9, line 1, cancel the”,”.
- 15    On page 9, line 4, cancel the “-“ and substitute therefor a --;--.
- On page 9, line 4, cancel “is”.
- On page 9, line 8, insert --of the present invention shown-- after “embodiment”.
- On page 10, line 12, cancel the “-“ and substitute therefor a --,--.
- 20    On page 10, line 13, cancel the “-“ and substitute therefor a --,--.
- On page 10, line 26, cancel the “-“ and substitute therefor a --(--.
- On page 10, line 27, cancel “corresponds” and substitute therefor -- corresponding to--.
- On page 10, line 27, cancel “to”.
- 25    On page 10, line 30, cancel the “-“ and substitute therefor a --)--,.
- On page 10a, line 1, cancel “one” and substitute therefor --an alternative--.
- On page 10a, line 1, cancel “variant”.
- On page 10a, line 2, cancel “according to” and substitute therefor --of--.
- On page 10a, line 2, insert --present-- before “invention”.

- On page 10a, line 4, cancel "which" and substitute therefor --with--.
- On page 11, line 3, insert --above-- before "example".
- On page 11, line 4, cancel "quoted above,".
- On page 11, line 9, cancel "comprises" and substitute therefor --includes--.
- 5 On page 11, line 14, cancel "may".
- On page 11, line 14, insert --may-- after "possibly".
- On page 11, line 20, cancel "according to" and substitute therefor --of--.
- On page 11, line 23, cancel the "--" and substitute therefor a --;--.
- On page 11, line 23, cancel "to say" and substitute therefor a --,--.
- 10 On page, after line 29, insert the following paragraph:
- Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.--
- 15 On page 14 (last page), cancel lines 1-5, and substitute the following centered heading therefor:
- ABSTRACT OF THE DISCLOSURE--**
- On page 14, line 7, cancel "The" and substitute therefor --A--.
- On page 14, lines 7-8, cancel "according to the invention is used to
- 20 transmit" and substitute therefor --for transmitting--.
- On page 14, line 8, cancel "(zs10)".
- On page 14, line 9, cancel "(bs)".
- On page 14, line 10, cancel "(KN)".
- On page 14, line 11, cancel "(VC11-VC1N)".
- 25 On page 14, line 12, cancel "(KN)".
- On page 14, line 13, cancel "(zs10)".
- On page 14, line 14, cancel "(sz)".
- On page 14, line 16, cancel "(VC11-VC1N). A" and substitute therefor --
- wherein a--.

On page 14, line 16, cancel “(bs)”.  
On page 14, line 17, cancel “thus”.  
On page 14, lines 17-18, cancel “(VC11-VC1N)”.  
On page 14, cancel line 20.

5     **In the Claims:**

On page 12, cancel line 1, and substitute the following left-hand justified heading therefor:

**--We Claim As Our Invention:--**

10    Please cancel claims 1-5, without prejudice, and substitute the following claims therefor:

6.       A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided, the method comprising the steps of:

15       converting the continuous bit stream to an ATM-oriented cell stream; and  
transmitting the ATM-oriented cell stream distributed between the at least two virtual connections, wherein synchronization cells are regularly inserted, at least at times, into the at least two virtual connections.

20       7.       A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, the method further comprising the step of:

defining the synchronization cells by a synchronization cell identifier in a header part of the ATM cells.

25       8.       A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein the synchronization cells respectively contain a sequence number.

9. A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein the ATM-oriented cell stream has a transmission bit rate which is greater than respective maximum transmission bit rates of the two virtual  
5 connections.

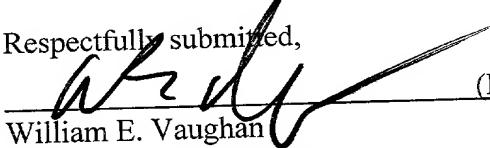
10. A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein assembly into one of the original ATM-oriented cell  
10 stream and the original continuous bit stream is carried out with the aid of the synchronization cells after transmission via the at least two virtual connections.

#### R E M A R K S

The present amendment makes editorial changes and corrects typographical  
15 errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claims 1-5 have been canceled in favor of new claims 6-10. Claims 6-10 have been presented solely because the revisions by bracketing and underlining which would have been necessary in claims 1-5 in order to present those claims in accordance with  
20 preferred United States Patent practice would have been too extensive, and thus would have been too burdensome. The amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-7 does not constitute an intent on the part of the Applicants to surrender any of the subject  
25 matter of claims 1-5.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

  
(Reg. No. 39,056)

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Attorneys for Applicants

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## Description

Method for transmitting an ATM-oriented cell stream via at least two virtual connections in an ATM  
5 communications network

When virtual private networks are being set up, the information is frequently transmitted between the switching devices in the virtual private networks by  
10 means of fixed connections, that is to say with the aid of continuous bit streams. The transmitted digital or digitized information represents, for example, voice, text, data, characters, graphics, still images or moving images. In the specialist world, such  
15 information is also referred to as user information.

In Europe, fixed connections based on the plesio-chronous digital hierarchy PDH which provides, for example, transmission capacitors of 64 Kbit/s,  
20 2 Mbit/s, 34 Mbit/s and 140 Mbit/s, are used for bit streams up to 140 Mbit/s. In the USA, fixed connections, for example based on hierarchy levels DS1 and DS3, are provided for this purpose, with transmission capacities of 1.5 Mbit/s and 45 Mbit/s,  
25 respectively, or based on the synchronous optical network SONET, for example 51.84 Mbit/s. For bit streams at more than 155 Mbit/s, fixed connections are generally provided on the basis of the synchronous digital hierarchy SDH which provides, for example,  
30 transmission capacities of 155 Mbit/s, 622 Mbit/s or 2.5 Gbit/s; the same hierarchy levels are provided in the SONET in the USA for more than 155 Mbit/s.

The transmission capacity of the fixed connections  
35 which are required to set up a virtual private network and are normally rented from a network operator depends on the amount of information to be transmitted. In this case, owing to the relatively major differences between

the transmission capacities of the hierarchy levels,  
optimum matching

between the transmission capacity required and that provided is frequently impossible.

With the increasing integration of voice and data networks, the present-day PDH, SONET and SDH networks are increasingly being replaced by networks which are set up on the basis of the asynchronous transfer mode ATM. This technology allows ATM-oriented fixed connections - so-called "virtual connections" or "permanent virtual connections" - to be set up, via which information is transmitted by means of so-called "ATM cells" which each comprise a header part, which is composed of five octets and is used for control, and an information part, which is composed of 48 octets and is used for information transmission.

The transmission capacity of a virtual connection is freely variable - that is to say it is independent of the hierarchy levels in the PDH, SONET or SDH technology - while, owing to the switching of a virtual connection from the switching devices in an ATM network to a physical connection, the maximum transmission capacity of a virtual connection is limited to the maximum transmission capacity of the transmission technology which is used on the physical connections of the communications network and with whose aid the virtual connections are transmitted.

When a network migrates, for example, from SDH to ATM technology, the core area of the network is normally converted first of all to the ATM technology, while SDH technology is still used in the periphery of the network. In the process, the previously SDH-oriented fixed connections must be provided in the core area with the aid of virtual connections. This is normally done by embedding the continuous bit stream of an SDH-oriented fixed connection in the information parts of the ATM cells of a virtual connection - the continuous

bit stream is converted to an ATM-oriented cell stream.  
This technology is

also referred to in the specialist world as "transparent" transmission or as the circuit emulation service CES. One known method for this is described in ITU-T Standard I.363.1, and this is known to persons  
5 skilled in the art as the ATM Adaptation Layer 1, or as AAL-1.

The cell headers which also need to be transmitted with each ATM cell increase the bit rate of the ATM-oriented  
10 cell stream over the bit rate of the continuous bit stream for an SDH-oriented fixed connection. If, for example, the continuous bit stream for an SDH fixed connection has a bit rate of 622 Mbit/s, then, after conversion to an ATM-oriented cell stream, the bit  
15 stream has a bit rate of at least 687 Mbit/s. This bit rate is increased further when the AAL-1 method is used since, in this method, at least one octet of further control information is transmitted in the information part of the ATM cells, which results in the bit rate of  
20 the ATM-oriented cell stream being increased to at least 701 Mbit/s. If the transmission technology which is used for the physical connections of a communications network is now limited, for example, to a maximum transmission capacity of 622 Mbit/s, a  
25 problem occurs in that the ATM-oriented cell stream cannot be transmitted using one virtual connection, since the transmission capacity of the transmission technology is not sufficient for the physical connections.  
30

It is known for the existing transmission technology to be replaced by a transmission technology using a transmission capacity which is sufficient for transmission of the ATM-oriented cell stream, for  
35 example an SDH technology with a transmission capacity of the next higher hierarchy level. In this case, additional investment is required to upgrade the transmission technology and, since there is a relatively major step-function change in the

transmission capacity between the hierarchy levels, transmission capacity remains unused. In principle, this substitution is impossible unless transmission technology

having a greater transmission capacity is available; for example, at the moment, no SDH system with a 2.5 Gbit/s transmission capacity for each physical connection is yet commercially available.

5

- European Patent Application EP 0 576 856 A3 discloses a method in which a continuous bit stream, which requires a higher transmission capacity than that of the virtual connections in an ATM communications network, is distributed between at least two virtual connections. The continuous bit stream is subdivided into bit groups whose numbers of bits plus a defined number of control bits corresponds to the total number of bits which can be transmitted as user information in the information part of an ATM cell - the continuous bit stream is converted to an ATM-oriented cell stream. In successive control cycles, at least two bit groups are in each case taken from the continuous bit stream and, with the addition of a sequentially changing bit group sequence number, are inserted into the information part of ATM cells. These ATM cells are transmitted separately via the at least two virtual connections, and are then assembled again, as a function of the bit group sequence number, to form the original bit stream. In this method, the continuous bit stream is always subdivided into bit groups. If the continuous bit stream already represents an ATM cell stream, not only the information parts but also the cell headers of this ATM cell stream are transmitted as user information in the information part of the newly formed ATM cells, as a result of which two cell headers are transmitted, and this is associated with a reduction of the throughput rate of the actual user information.
- 35 European Patent 0584398 discloses a method in which an ATM-oriented cell stream takes place over at least two virtual connections as a development of the method described in European Patent Application

- EP 0 576 856 A3. In this case, the duplicated transmission of the cell headers is avoided in that the ATM cell stream contained in the continuous bit stream is depacketized before the subdivision into bit groups.
- 5 This involves increased control complexity. The subdivision of the continuous bit stream into bit groups, which is always provided in European Patent Application EP 0 576 856 A3, takes place unchanged.
- 10 The invention is thus based on the object of improving the transmission of an ATM-oriented cell stream in an ATM communications network via at least two virtual connections.
- 15 The major aspect of the invention is that an ATM-oriented cell stream is transmitted via an ATM communications network in which at least two virtual connections are provided in the ATM communications network, in which the ATM-oriented cell stream is
- 20 distributed between the at least two virtual connections, and in which, at least at times, synchronization cells are regularly inserted into the virtual connections. A major advantage of the method according to the invention is that the information
- 25 parts of the cells of the ATM-oriented cell stream are supplied unchanged to the virtual connections. The information parts may thus contain any desired user data. A further advantage of the invention is that the synchronization cells mean that it is possible to
- 30 determine the propagation time differences between the ATM cells transmitted via the virtual connections. When an appropriately large number of ATM cells which have been transmitted via the virtual connections have been stored in the receiving device, it is thus possible to
- 35 obtain the assembly of the original ATM-oriented cell stream - that is to say with the original sequence of the ATM cells. In addition, the distribution process advantageously results in the load from the transmission capacity required for transmission of the

ATM-oriented cell stream being distributed between the physical connections, provided the virtual

connections are routed via different physical connections.

One advantageous refinement of the method according to  
5 the invention results in the synchronization cells being defined by a synchronization cell identifier in the header part of ATM cells - claim 2. This is linked to the advantage that any desired bit combination can be transmitted in the information parts of the  
10 transmitted ATM cells since there is no need to define any specific bit combination as a synchronization cell.

A further refinement of the method according to the invention provides for the synchronization cells to  
15 contain a sequence number - claim 3. This is linked to the advantage that propagation time differences of any magnitude can be determined if a sufficiently large number of bits are used for transmission of the sequence numbers in the information part of the  
20 synchronization cells - for example 32 bits. If, for example, a synchronization cell is introduced after each 32 user cells and the transmission takes place at a bit rate of 622 Mbit/s, then, if the sequence number comprises nine bits, it is possible to determine a  
25 difference of about 1 000 km between the lengths of the physical connections via which the virtual connections are transmitted.

According to one variant of the method according to the  
30 invention, the ATM-oriented cell stream has a transmission bit rate which is greater than the respective maximum transmission bit rates of the virtual connections - claim 4. This advantageously makes it possible to transmit the ATM-oriented cell  
35 stream if, for example for technical reasons, it is impossible to increase the transmission bit rates of the virtual connections, or this is not done for financial reasons.

One development of the method according to the invention provides for assembly into the original ATM-oriented cell stream to be carried out with the aid of the synchronization cells after transmission via the virtual connections - claim 5. This advantageously ensures that the sequence of the cells in the ATM-oriented cell stream is reproduced after transmission via the virtual connections.

10 According to one development of the method according to the invention, a continuous bit stream is converted to the ATM-oriented cell stream and is transmitted with the aid of the ATM-oriented cell stream - claim 6. This has the advantage that, for example if an SDH-oriented  
15 network is being replaced by an ATM-oriented network, already existing fixed connections can still be carried, unchanged, via the new ATM network.

According to one variant of the method according to the invention, the continuous bit stream is converted to the ATM-oriented cell stream in accordance with ITU-T Standard I.363.1 - claim 7. This means that it is already possible to transmit continuous bit streams converted in accordance with the Standard via the  
25 virtual connections.

One alternative form of the method according to the invention provides for assembly into the original continuous bit stream to be carried out with the aid of the synchronization cells after transmission via the virtual connections - claim 8. Appropriate storage of the ATM cells transmitted via the virtual connections, and appropriate access to this memory, allows the original bit stream to be assembled without any  
30 previous assembly of the original ATM-oriented cell stream.

The method according to the invention will be explained in the following text with reference to a figure. By way of example, the figure shows an ATM communications network (KN) in which a number of virtual connections 5 (VC11-VC1N) are provided. A number of switching devices (VE1-VE6) are used for switching the ATM cells transmitted in the virtual connections and are connected to one another by means of physical connections - indicated indirectly in the figure by the 10 virtual connections (VC11-VC1N). The various routes through the ATM communications network (KN) indicate that the virtual connections (VC11-VC1N) are routed via different physical connections. The virtual connections (VC11-VC1N) are routed between two matching units 15 (VIMA1-VIMA2) which are connected to the switching devices (VE1-VE6), with the first matching unit (VIMA1) being used for the distribution of an ATM-oriented cell stream (zs10) for transmission via the virtual connections (VC11-VC1N), and the second matching unit 20 (VIMA2) being used for a combination of the original ATM-oriented cell stream (zs10) after transmission via the virtual connections (VC11-VC1N). The matching units (VIMA1-VIMA2) can alternatively be integrated in the switching devices (VE1-VE6) - as is indicated by the 25 dashed illustration of the switching devices VE5 and VE6. Two conversion units (CES1-CES2) are provided for converting a continuous bit stream (bs) transmitted, for example, via a fixed connection. The first conversion unit (CES1) is connected to the first 30 matching unit (VIMA1) and converts the continuous bit stream (bs) to an ATM-oriented cell stream (zs10), which may be transmitted in a further virtual connection (VC10). The second conversion unit (CES2) is connected to the second matching unit (VIMA2) and 35 converts the ATM-oriented cell stream (zs10), which may be transmitted in the further virtual connection (VC10), to the original continuous bit stream (bs). Optionally, the second conversion device (CES2) may be dispensed

with, if the assembly of the original continuous bit stream (bs) takes place without assembly of the original ATM-oriented cell stream (zs10) in the second matching unit (VIMA2) - as is illustrated by the dashed 5 representation of the further arrow, which is denoted bs.

For the exemplary embodiment, it is assumed that the first conversion unit (CES1) is supplied with a 10 continuous bit stream (bs) which it converts to an ATM-oriented cell stream (zs10). One example of conversion is described in International Standard I.363.1 from the ITU-T. The ATM-oriented cell stream (zs10) is now supplied to the first matching unit (VIMA1) and is 15 distributed from there between the connected virtual connections. If the ATM-oriented cell stream (zs10) is transmitted via the further virtual connection (VC10), the connection identifier of the further virtual connection (VC10), which is transmitted in the header 20 part of a supplied ATM cell (z) in accordance with the ATM Standard, is replaced by the connection identifier of that virtual connection to which the supplied ATM cell (z) is distributed by the matching unit (VIMA1). The ATM-oriented cell stream (zs10) distributed in this 25 way is then transmitted via the virtual connections (VC11-VC1N) in the form of further ATM-oriented cell streams (zs11-zs1N) via the ATM communications network (KN) to the second matching unit (VIMA2).

Owing to the different routes via the switching devices (VE1-VE6), different propagation times may occur for 30 the ATM cells transmitted in the virtual connections. Synchronization cells (zs) are regularly inserted into the virtual connections in the first matching unit 35 (VIMA1) in order to determine the propagation time differences, and are defined by a synchronization cell identifier (szk) in the header part of ATM cells. Such insertion is required, for example, when setting up the virtual connections (VC11

-VC1N) in order to determine the propagation time differences for the first time. Synchronization cells (sz) also need to be inserted at times if synchronizm is lost. When synchronizm exists, it is possible to dispense with the transmission of the synchronization cells (sz), thus increasing the throughput rate of the virtual connections (VC11-VC1N). If the propagation time differences are relatively long, it is possible for synchronization cells (sz) which have been inserted at the same time into the virtual connections (VC11-VC1N) to be received in the second matching unit (VIMA2) shifted with respect to one another - as a result of very different propagation times - to such an extent that it is no longer possible to associate the synchronization cells (sz) with one another. In this case, synchronization cells (sz) which have been inserted into the virtual connections (VC11-VC1N) at the same time can be identified with the aid of an identical sequence number (sn), so that it is possible to associate the synchronization cells (sz) with one another in the second matching unit (VIMA2). If, for example, the ATM cells are transmitted at a bit rate of 622 Mbit/s, approximately 1 666 ATM cells are transmitted per millisecond. If the propagation time difference of the ATM cells transmitted via the virtual connections (VC11-VC1N) is, for example, 5 ms - this corresponds approximately to a length difference of 1000 km between the physical connections via which the virtual connections (VC11-VC1N) are carried and to transmission of 8,333 ATM cells - and if a synchronization cell (sz) is inserted after each 32 ATM cells, then two synchronization cells (sz) which have been inserted into the virtual connections (VC11-VC1N) at the same time are received in the second matching unit (VIMA2) shifted by up to 260 synchronization cells (sz) with respect to one another. A sequence number (sn) of at least nine bits is therefore required for unique identification of the two synchronization cells (sz).



According to one embodiment variant of the method according to the invention, the original ATM-oriented cell stream (zs10) is now assembled in the second matching unit (VIMA2) which the aid of the 5 synchronization cells (sz). In this case, the received

- ATM cells have to be temporarily stored in a memory device (SP) in order to compensate for the propagation time differences. In the case of the example of transmission at a bit rate of 622 Mbit/s, quoted above,
- 5 and with a maximum propagation time difference between the ATM cells of 5 ms, it is necessary to store approximately 66 664 ATM cells if transmission takes place via, for example, eight virtual connections (VC11-VC1N), so that the memory device (SP) comprises
- 10 approximately 4 Mbytes. The original ATM-oriented cell stream (zs10) is now taken from the second matching unit (VIMA2) and is supplied to the second conversion unit (CES2), in which case the original ATM-oriented cell stream (zs10) may possibly be contained in the
- 15 further virtual connections (VC10). Finally, the original ATM-oriented cell stream (zs10) is converted to the original continuous bit stream (bs) in the second conversion unit (CES2).
- 20 In a further variant of the method according to the invention, the original continuous bit stream (bs) is assembled in the second matching unit (VIMA2) with the aid of the synchronization cells - that is to say without the original ATM-oriented cell stream (zs10)
- 25 being assembled. In this case, the transmitted bit stream parts are taken from the information parts of the ATM cells which have been temporarily stored in the memory device (SP), and are assembled to form the original continuous bit stream (bs).

## Patent Claims

1. A method for transmitting an ATM-oriented cell stream (zs10) via an ATM communications network  
5 (KN),  
in which at least two virtual connections (VC11-VC1N) are provided in the ATM communications network (KN),  
in which the ATM-oriented cell stream (zs10) is  
10 distributed between the at least two virtual connections (VC11-VC1N), and  
in which, at least at times, synchronization cells (sz) are regularly inserted into the virtual connections (VC11-VC1N).  
15
2. The method as claimed in claim 1,  
characterized  
in that the synchronization cells (sz) are defined  
20 by a synchronization cell identifier (szk) in the header part of ATM cells.
3. The method as claimed in one of claims 1 or 2,  
characterized  
in that the synchronization cells (sz) contain a  
25 sequence number (sn).
4. The method as claimed in one of the preceding  
claims,  
characterized  
30 in that the ATM-oriented cell stream (zs10) has a transmission bit rate which is greater than the respective maximum transmission bit rates of the virtual connections (VC11-VC1N).
- 35 5. The method as claimed in one of the preceding  
claims,  
characterized  
in that assembly into the original ATM-oriented cell stream (zs10) is carried out with the aid of

the synchronization cells (sz) after transmission via the virtual connections (VC11-VC1N).

6. The method as claimed in one of the preceding  
claims,

5 characterized

in that a continuous bit stream (bs) is converted  
to the ATM-oriented cell stream (zs10) and is  
transmitted with the aid of the ATM-oriented cell  
stream (zs10).

10

7. The method as claimed in claim 6,

characterized

in that the continuous bit stream (bs) is  
converted to the ATM-oriented cell stream (zs10)  
15 in accordance with ITU-T Standard I.363.1.

15

8. The method as claimed in one of claims 6 or 7,

characterized

20 in that assembly into the original continuous bit  
stream (bs) is carried out with the aid of the  
synchronization cells (sz) after transmission via  
the virtual connections (VC11-VC1N).

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Patent Claims

1. A method for transmitting a continuous bit stream (bs) via an ATM communications network (KN) in which at least two virtual connections (VC11-VC1N) are provided, comprising the following steps:
  - 5 - the continuous bit stream (bs) is converted to an ATM-oriented cell stream (zs10), and
  - the ATM-oriented cell stream (zs10) is transmitted distributed between the virtual connections (VC11-VC1N), with synchronization cells (sz) being regularly inserted, at least at times, into the virtual connections (VC11-VC1N).
- 15 2. The method as claimed in claim 1, characterized in that the synchronization cells (sz) are defined by a synchronization cell identifier (szk) in the header part of ATM cells.
- 20 3. The method as claimed in one of claims 1 or 2, characterized in that the synchronization cells (sz) contain a sequence number (sn).
- 25 4. The method as claimed in one of the preceding claims, characterized in that the ATM-oriented cell stream (zs10) has a transmission bit rate which is greater than the respective maximum transmission bit rates of the virtual connections (VC11-VC1N).
- 30 35 5. The method as claimed in one of the preceding claims, characterized

- 12a -

in that assembly into the original ATM-oriented cell stream (zs10) or the original continuous bit stream (bs) is carried out with the aid of

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- 13 -

the synchronization cells (sz) after transmission  
via the virtual connections (VC11-VC1N).

Abstract

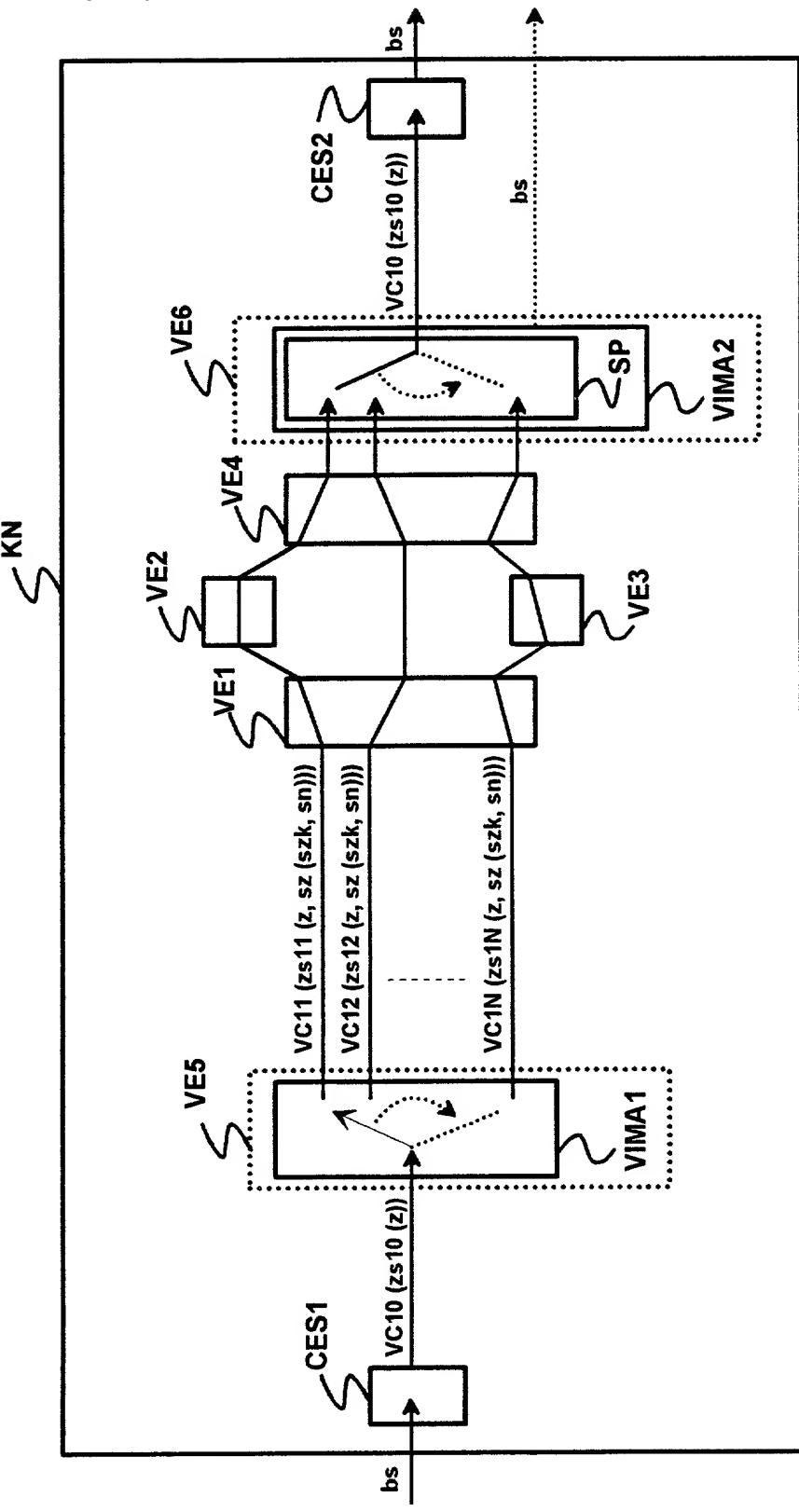
Method for transmitting an ATM-oriented cell stream via at least two virtual connections in an ATM communications network

The method according to the invention is used to transmit an ATM-oriented cell stream (zs10), which transmits a continuous bit stream (bs), via an ATM communications network (KN), with at least two virtual connections (VC11-VC1N) being provided in the ATM communications network (KN), between which the ATM-oriented cell stream (zs10) is distributed, and in which, at least at times, synchronization cells (sz) are regularly inserted in the virtual connections (VC11-VC1N). A high-bit-rate continuous bit stream (bs) can thus be transmitted via virtual connections (VC11-VC1N).

Figure 1

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FIG 1



**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**

(Includes Reference to PCT International Applications) PCT/DE99/02649

ATTORNEY'S  
DOCKET NUMBER  
112740-143

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM COMMUNICATIONS NETWORK**

the specification of which (check only one item below):

 is attached hereto. was filed as United States applicationSerial No. 09/763,444on February 21, 2001

and was amended

on \_\_\_\_\_ (if applicable).

 was filed as PCT international application

Number \_\_\_\_\_

on \_\_\_\_\_

and was amended under PCT Article 19

on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

COUNTRY (If PCT Indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany	198 38 420.3	24 August 1998	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

Combined Declaration For Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications) PCT/DE99/02649				ATTORNEY'S DOCKET NO. 112740-143
<p>I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, Untied States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:</p>				
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:				
U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER		U.S. FILING DATE	PATENTED	PENDING
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO		PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)	
<p><b>POWER OF ATTORNEY:</b> As a named inventor, I hereby appoint the following attorney(s) Holby M. Abern (P47,372), Robert M. Barrett (30,142), Alan L. Barry (30,819), Thomas C. Basso (46,541), Jeffrey H. Canfield (38,404), Robert W. Connors (46,639), Amy J. Gast (41,773), Timothy L. Haney (38,174), Patricia A. Kane (46,446), Michael S. Leonard (37,557), Edward A. Lehman (22,312), Adam H. Masia (35,602), Dante J. Picciano (33,543), Renato L. Smith (45,117), Maurice E. Teixeira (45,646), William E. Vaughan (39,056), Austin Victor (47,154), and all members of the firm of Bell, Boyd &amp; Lloyd LLC.</p>				
Send Correspondence to:				Direct Telephone Calls to:
<u>William E. Vaughan</u> <u>BELL, BOYD &amp; LLOYD LLC</u> <u>P.O. Box 1135</u> <u>Chicago, Illinois 60690</u>				312/807-4292
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2 0 2	FULL NAME OF INVENTOR	FAMILY NAME <u>RAU</u>	FIRST GIVEN NAME <u>PETER</u>	SECOND GIVEN NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS <u>Bad Ischl Str. 11</u>	CITY <u>81241 Muenchen</u>	STATE & ZIP CODE/COUNTRY <u>Germany</u>
2 0 3	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.</p>				
SIGNATURE OF INVENTOR 201		SIGNATURE OF INVENTOR 202		SIGNATURE OF INVENTOR 203
<u>Siegfried Huber</u>		<u>Peter Rau</u>		
DATE	DATE	DATE		DATE
<u>23rd of April 2001</u>		<u>25nd of April 2001</u>		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201      SIGNATURE OF INVENTOR 202      SIGNATURE OF INVENTOR 203

## GIORNATE DI INVENTORES

*Seaweed Harbor*      *Peter Karp*  
DATE 10-10-01 DATE 10-10-01

SIGNATURE OF INVENTOR 203

*see above*

*Teter Ray*